ENCLOSURE 1

WATTS BAR NUCLEAR PLANT

ELECTRICAL CONDUIT SUPPORT

Corrective Action Program Plan

Revision 1

WATTS BAR NUCLEAR PLANT

ELECTRICAL CONDUIT AND CONDUIT SUPPORT CORRECTIVE ACTION PROGRAM PLAN

REVISION 1

Prepared

Reviewed (Lead Engineer) (Branch Specialist)

Approved (Branch Chief)

Approved (Project Engineer)

Approved (Site Director)

Concurred (Watts Bar Program Team)

TABLE OF CONTENTS

1.0 INTRODUCTION

Employee Concerns, Conditions Adverse to Quality (CAQs), and the Weld Task Group (WTG) identified deficiencies in the conduit support program for the Watts Bar Nuclear Plant (WBN). This resulted in several Condition Adverse to Quality Reports (CAQRs), some of which were determined to be significant.

Significant Condition Report (SCR) 6463-S, written in November 1985 as a result of employee concerns, described conditions that indicated a lack of control in the installation of safety-related electrical conduit supports. Specific problem areas included supports installed and accepted without the required change documents (Field Change Requests or Support Variance Sheets), supports not tagged, supports documented on inspection records as incorrect typical type, and inconsistencies between the conduit support tracking program and actual installed supports. Additionally, other CAQs have since been identified involving deficiencies with other installation issues. In addition, design conditions have been identified involving discrepancies in design input and design output. A list of CAQs affecting structural qualification of conduit and conduit supports identified to date is included as Attachment 1.

In November 1987, 70 conduit supports were selected for review to gain better insight into specific nonconforming attributes. The structural attributes found to potentially require field work included conduit clamps, conduit runs supported only at one location, and excessively cantilevered sections of conduit runs. The quality assurance/quality control (QA/QC) records check for these supports revealed that in numerous instances the inspection documentation was either missing or incorrect.

Concerns identified are categorized as follows:

- Discrepancies in the design basis.
- Design output not enveloping all design parameters.
- Installed configurations not complying with design documents.
- Discrepancies between installed configurations and inspection documentation.

The root causes of these concerns exist in both engineering and construction activities. The following root causes address in order, the four concerns identified above:

- Incomplete design criteria, in that several critical design attributes were not recognized or accounted for, due in part to inadequate interdisciplinary interface review.

- Engineering did not completely implement the design criteria and did not perform an adequate design review in some cases.
- Fragmented and unclear installation requirements.
- Unclear inspection requirements.

2.0 OBJECTIVE

The objective of this Corrective Action Program (CAP) is to assure that the WBN conduit and conduit support installations are structurally adequate and comply with licensing requirements and the design criteria. Revisions will be made to the design criteria and to the Final Safety Analysis Report (FSAR) to ensure compatibility of the design criteria with the FSAR commitments. Licensing commitment changes will be proposed only when technically justified.

3.0 SCOPE

The scope of this CAP is the safety-related [Category I and I(L)] conduit and conduit supports required for unit 1 operation.

4.0 DESCRIPTION OF PROGRAM

4.1 Program Phases, Major CAP Elements, and Evaluations

TVA will perform an engineering evaluation of safety-related conduit and conduit support installations required for unit 1 operation. Known deficiencies, which will be resolved under this CAP, are listed in Attachment 1. A flow chart and fragnet for the work are illustrated in Attachments 2 and 3, respectively.

The CAP plan consists of the following actions:

- Complete and document the design basis.
- Update design output documents to be consistent with the completed design basis.
- Revise construction, maintenance, and QA procedures to incorporate design output requirements.
- Develop and implement a critical case evaluation of existing installations with corrective action, as necessary. The number of critical cases to be evaluated will depend on the assessment of walkthrough data.

The four parts of the CAP plan are described in the following sections.

4.1.1 Complete and Document the Design Basis

The existing conduit and conduit support design criteria (Reference 1) will be reviewed for technical adequacy and agreement with the FSAR and other licensing commitments. The design criteria and FSAR will be revised as required to establish a complete and technically adequate design basis. Licensing commitment changes will be proposed only when technically justified.

4.1.2 Update Design Output Documents to Be Consistent With Completed Design Basis

As a result of deficiencies associated with existing design output documents, Stop Work Authority (SWA) 26 (Reference 2) is currently in place requiring engineering approval (by use of a change document) prior to conduit support installation. Final engineering approval of the change documents will not be given until the revised design criteria are issued.

In order to correct the deficiencies identified in the design output documents, the following actions will be taken:

- An Engineering Requirements Specification (ER Spec) will be issued to define the structural requirements for conduit and conduit support installation.

- Existing typical support designs will be reviewed and revised as required to be in compliance with the revised design criteria.

- New typical support designs will be developed and issued to provide additional details for standard installations.

The SWA will not be released until the new typical drawings and the ER Spec are issued and the existing typical drawings are qualified to the revised design criteria.

4.1.3 Revise Implementing Procedures

After issuing the ER Spec, construction, maintenance, and QA implementing procedures will be reviewed and revised as necessary to ensure proper implementation of engineering requirements.

4.1.4 Develop and Implement a Critical Case Evaluation of Existing Installations

Because of the problems identified in the design, construction, and inspection of conduits and conduit supports, TVA will perform a critical case evaluation of the installed safety-related conduit and conduit supports required for unit 1 operation.

Definition of Critical Cases

Since the existing conduits and conduit supports were field routed, as-built configurations are not known and specific deficiencies must be identified through a field walkthrough.

The engineering walkthrough will consist of a review of installed safety-related conduit and conduit support configurations by engineering personnel who will focus on those attributes essential to conduit and conduit support qualification. Parameters such as conduit span, spacing of anchor bolts, and cantilever length of free ends will usually be screened based on visual examination. Actual measurements will be taken when necessary. The engineering walkthrough will be performed by teams of engineering personnel familiar with the conduit and conduit support design basis for WBN. These teams of engineering personnel will be trained to identify critical cases based on the following:

° Installed typical designs that required revision to meet design criteria requirements.

° Installed typical designs determined to be sensitive to the identified types of installation deficiencies by an engineering prescreening of the original typical designs.

° Installed nontypical designs resulting from variances to original typical support designs which are sensitive to identified installation deficiencies.

In addition to the evaluation of critical cases discussed above, obviously unacceptable installations such as missing clamps or supports will be documented and corrected.

Random, independent reviews of the engineering walkthroughs will be performed to assure adequacy of critical case selections. The review will be performed by engineering personnel qualified to the same requirements as members of the original walkthrough team.

When information is required that cannot be obtained by engineering personnel during the walkthrough, such as bolt torque, Nuclear Construction (NC) or Nuclear Quality Assurance (NQA) will obtain the required information.

Implementation of Critical Case Evaluations

Critical cases identified and sketched by walkthrough teams will be grouped and categorized and further reviewed to determine the final critical cases for evaluation that envelop the total population of conduit supports. The as-built configuration for the final critical cases will be

verified by NQA. It is expected that most of the final critical cases will be evaluated analytically, although testing may be utilized.

Subsequent to the evaluation of the final critical cases, those critical cases that do not meet the design criteria will be reviewed and unacceptable attributes will be identified. These particular attributes will then be reviewed for the entire population with field modifications implemented as required.

For further details of the critical case evaluation program, see Exhibit A.

4.2 Recurrence Control

Recurrence control actions are provided to address the root causes. The specific steps involved in recurrence control are as follows, in order corresponding to the root causes listed in Section 1.0:

° Revision and maintenance of the Design Basis Document per Nuclear Engineering Procedure (NEP) 3.2.

Interface review requirements have been strengthened through the issuance of the NEPs and increased emphasis on procedural training. No further action is required in this area.

° Training to the revised design criteria and strengthened engineering procedures (NEPs), which require an independent design verification of methods used.

° Issuance of the ER Spec as a single document for structural requirements pertaining to the installation, maintenance, and inspection of conduit and conduit supports.

Revise implementing procedures to incorporate applicable ER Spec requirements.

Training to revised implementing procedures.

° Recurrence control for the unclear inspection requirements will be the same as for the previous item.

4.3 Licensing Assessment

There are two specific aspects in the design criteria that are different from the FSAR. The damping values to be used in seismic analysis of conduit supports are currently specified in FSAR Section 3.10.3 as 0.1 percent for operating basis earthquake (OBE) and 2 percent for safe shutdown earthquake (SSE). (It should be noted that the 0.1 percent is a typographical error and should be 1 percent.) A technically justified FSAR revision will be submitted to NRC to update damping values. Development of these updated damping values will be done under the Seismic Analysis CAP. Also,

FSAR Section 3.7.3.5.1 states that the peak spectral acceleration will be used if the component is rigid. The use of spectral accelerations will be clarified.

Any other changes identified in licensing documents will be handled as specified in Section 4.1.1 in accordance with the requirements of the Design Baseline and Verification Program (DBVP).

5.0 PROGRAM INTERFACES

For the purposes of this CAP, two types of program interfaces are considered: production and programmatic. Production interfaces are those interfaces with other programs where one program's output impacts the scope of another program, but does not impact program methodology. Programmatic interfaces are those interfaces where one program's methodology or progress is contingent upon or at risk with respect to the results of another program.

5.1 Production Interfaces

WBN cable-related activities are being addressed under the Cable Issues, Electrical Issues, and Fire Protection Review CAPs which have the potential to impact conduit and conduit support installation by requiring modifications and/or rerouting. These activities include the following:

- Separation requirements
- Added firewrap
- Cable pullbys
- Cable proximity to hot pipes
- Cable support in vertical conduit
- Cable bend radius
- Cable splice
- Ampacity

5.2 Programmatic Interfaces

- DBVP - The conduit support design criteria is a portion of the Design Basis Document output by DBVP.
- Seismic Analysis CAP - Will provide input into this CAP with respect to seismic parameters.
- QA Records - The documentation resulting from the critical case evaluation program will be used to demonstrate the adequacy of the existing configurations.

6.0 PROGRAM IMPLEMENTATION

This CAP plan will be implemented by Nuclear Engineering (NE), NC, and NQA. Additionally, Nuclear Maintenance (NM) will be affected by revised NE output. The specific responsibilities are as listed below.

- NE is responsible for issuing revised design criteria, revised design output, evaluation procedures, identification and evaluation of critical cases, and the overall coordination of this program, including the final report.

- NC is responsible for revising any NC procedures required to implement revised NE output, providing support to NE during the engineering walkthrough, (e.g., opening junction boxes to provide access to bolts, having firewrap removed), and performing any required modifications.

- NQA and Engineering Assurance (EA) will perform audits and reviews to ensure the effectiveness of program activities and deliverables. Additionally, NQA is responsible for dimensional verification of final critical case sketches made during engineering walkthrough and revising any QA/QC procedures required to implement revised NE output. NQA is responsible for evaluating acceptability of existing inspection documentation as requested by NE on specific essential attributes.

- NM is responsible for revising any NM procedures required to implement revised NE output.

7.0 PROGRAM DOCUMENTATION

The CAP plan activities will be performed in accordance with approved instructions or procedures. Field data will be gathered in accordance with approved engineering walkthrough procedures. Calculations generated as a portion of this program will be performed and documented in accordance with TVA's NEPs. Any items in the evaluation program that do not meet the design criteria (e.g., cannot be qualified in as-installed configuration) will be identified, tracked and resolved through the CAQ process. Modifications will be handled through the Design Change Notice (DCN) program. A final report will be issued upon completion of the CAP activities.

8.0 CONCLUSION

This CAP plan includes a critical case evaluation program to assure the structural adequacy of existing safety-related conduit and conduit supports which are required for unit 1 operation. Before implementation of critical case evaluations, the design criteria will be reviewed and revised as necessary to ensure they are technically adequate and in compliance with licensing requirements. Technically justified changes to the licensing commitments will be proposed and the FSAR will be revised accordingly. Additionally, design output will be revised or developed to comply with design criteria and to adequately translate design requirements to NC. Any specific attributes not meeting the design

criteria will be modified as necessary. Upon completion of this CAP, WBN conduits and conduit supports will meet licensing requirements and program improvements will be in place to ensure adequacy of new or modified conduits and conduit supports.

9.0 REFERENCES

1. Design Criteria WB-DC-40-31.10, Revision 4 (B26 880531 036).

2. H. C. Johnson's memorandum to J. R. Lyons dated November 26, 1986 (B26 861126 060).

WBN CORRECTIVE ACTION PROGRAM PLAN - CRITICAL CASE EVALUATION PROGRAM TABLE

	PROGRAM PREPARATION		PHASE I - ENGINEERING OVERVIEW		PHASE III - ENGINEERING EVALUATION (level-I)	(level-II)	(level-III)	PROGRAM CLOSURE
GENERIC CRITICAL CASE EVALUATION PROGRAM	1) Review & revise design reqmt's 2) Establish pre-screen attributes, including CAQ issues. 3) Qualify existing details to revised design requirements	4) Define population 5) Prescreen the population for critical attributes	1) Develop evaluation plans 2) Prepare proced. 3) Training	4) Walkthrough to record critical cases with justification. 5) Review documents to identify critical cases with justification. 6) Walkthrough the selected critical cases which cover all the attributes. 7) Sketch data for the critical cases.	1) Grouping by comparison & categorization 2) Screen the case groups for final critical cases 3) Collect as-built data for the final critical cases with QC concurrence.	1) Final critical cases detailed analysis 2) Final critical cases actual testing	1) Review analysis or test results for acceptables 2) Determine the approach to fix un-resolved cases 3) Implement corrective action	Develop Final Report.
CONDUIT AND SUPPORTS CRITICAL CASE EVALUATION	1) YES. Complete Design Basis CAP Sect 4.1.1 2) YES. Prescreening will be used. CAP Sect. 4.1.4 3) YES. Existing design will be revised. CAP Sect. 4.1.2	4) YES. Scope defined CAP Sect. 3.0 5) YES. CAP Sect. 4.1.4	1) YES. CAP Sect. 4.1.4 2) YES. Walkthrough Procedure 3) YES. CAP Sect. 4.1.4	4) YES. CAP Sect 4.1.4 5) NA 6) NA 7) YES. Sketch critical cases. CAP Sect. 4.1.4	1) YES. Support types and groups. CAP Sect. 4.1.4 2) YES. Enveloped cases CAP Sect. 4.1.4 3) YES. CAP Sect. 4.1.4	1) YES, by analysis CAP Sect. 4.1.4 2) YES, if required. CAP Sect. 4.1.4.	1) YES, CAP Sect. 4.1.4 2) YES, CAP Sect. 4.1.4 3) YES, CAP Sect. 4.1.4	YES, CAP Sect. 7.0

EXHIBIT A

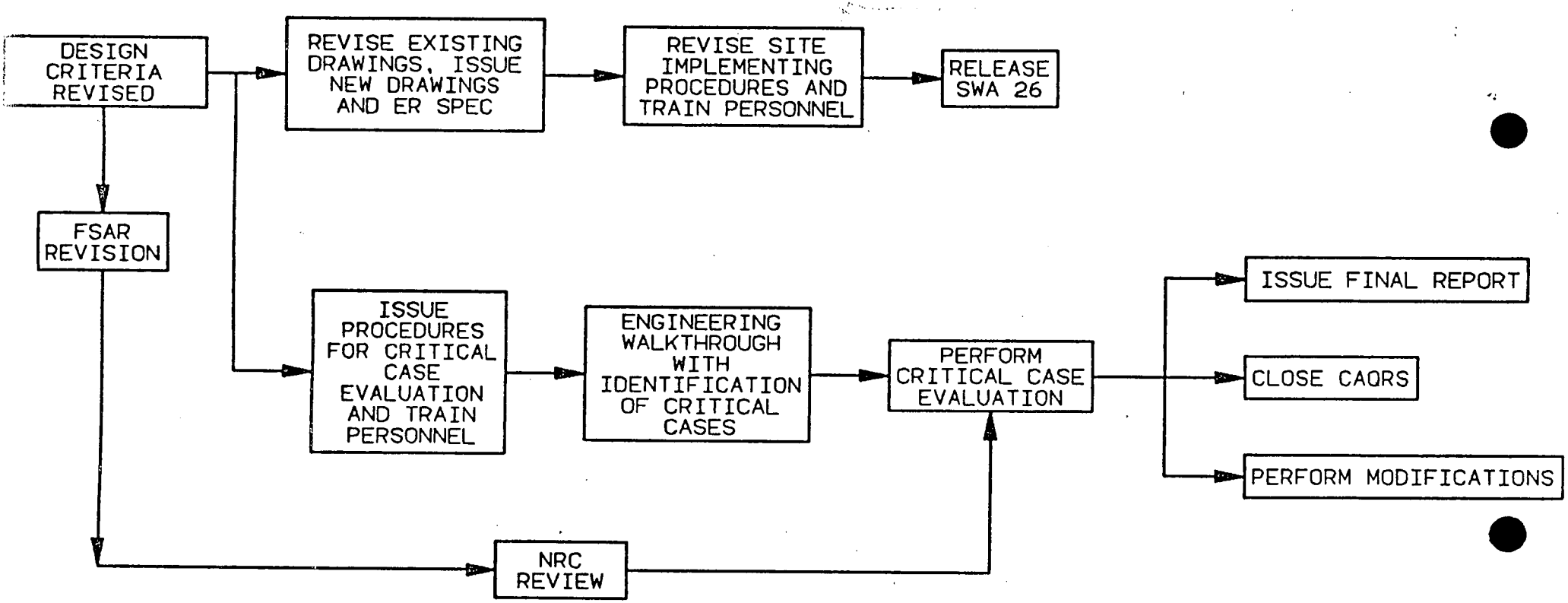
Attachment 1

BASIS OF CAP

DOCUMENT NUMBER	PROBLEM DESCRIPTION	REFERENCES
SCR WBN 6463-S (50.55[e])	Drawing & procedure mis-interpretation by craft, QC, & field engineers.	EC IN-85-458-006 EC IN-85-119-006 WBRD-50-390/86-14 WBRD-50-391/87-18
SCR 6794-S	Allowable cantilever lengths shown on 47A056-89 are exceeded.	
SCR 6867-S	Conduits not supported in accordance with drawing requirements in the vicinity of junction boxes.	
SCR WBN CEB8675 (50.55[e])	Typical supports do not envelope the worst case design parameters. No criteria for I(L) conduit, free ends, thermal loading, etc.	WBRD-50-390-86-14 WBRD-50-391-87-18
SCR WBN CEB8683	Drawings unclear as to required number of support points for rigid conduit (cable tray jumpers).	
PIR WBN CEB8708	Typical drawings allowed attachment (including conduit supports) to duct flange without consideration of differential movements between duct and adjacent attachment points.	
CAQR WBF870033	Inconsistencies exist in test data used to generate load tables for unistrut clamps.	PIR SQNCEB8745
CAQR WBF870034	Deflection of unistrut clamps not considered in the design of conduit supports.	SCR BFNCEB8702
CAQR WBF870087	Damping values specified in the FSAR and Design Criteria are different.	CATD 224.3WBN01
CAQR WBP870367	Screws have been used in conduit unistrut clamps instead of bolts.	
CAQR WBP870407	Note 43 on 47A056-16 was interpreted by QC to waive inspection requirements on concrete quality and anchor perpendicularity. (These two inspections were not intended to be waived by note 43.)	
CAQR WBP870818	Differential movement between buildings not considered	

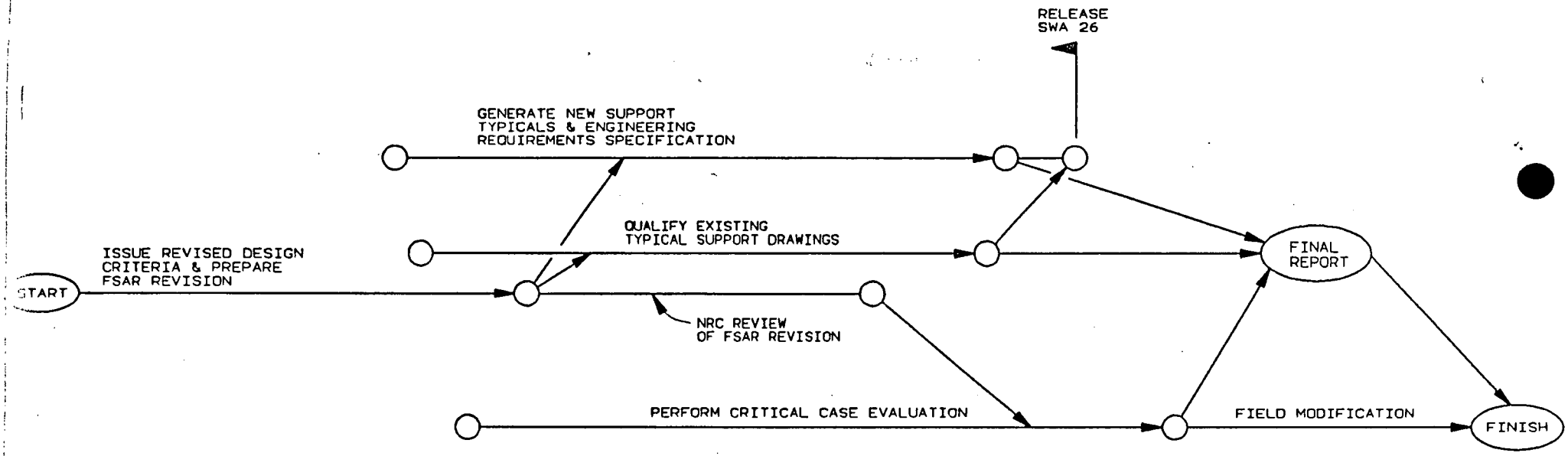
DOCUMENT NUMBER	PROBLEM DESCRIPTION	REFERENCES
CAQR WBP871061 (50.55[e])	No axial restraints provided on straight conduit runs longer than 30 feet.	WBRD-50-390/86-14 WBRD-50-391/87-18
CAQR WBP871145	Unconservative weights of conduit & insulation, thermal effects & no seismic qualification for some conduit hardware.	CAQRSQT870626
NCR W-333-P (50.55[e])	Conduit supports not spaced per drawings (Overspans).	WBRD-50-390/86-14 WBRD-50-391/87-18
NCR W-387-P	B-Line clamps, bolts & nuts were substituted for unistrut attachments without NE approval.	
NCR W-389-P (50.55[e])	Multiple condulets on free ends which violates the intent of drawing 47A056-102.	WBRD-50-390/86-14 WBRD-50-391/87-18
NCR W-403-P	No procedure to verify the effect of new conduit additions on varied support configurations.	
NCR W-420-P	Free end violations and lack of support requirements for oversized conduit bodies.	
NCR W-539-P	Conduit/junction box installations are not installed in accordance with drawings and procedures.	

WATTS BAR NUCLEAR PLANT
ELECTRICAL CONDUIT SUPPORTS
FLOWCHART



ATTACHMENT 2

WATTS BAR NUCLEAR PLANT
ELECTRICAL CONDUIT SUPPORTS
FRAGNET



ATTACHMENT 3

ENCLOSURE 2

For the Watts Bar Nuclear Plant, TVA commits to:

- Complete and document the design basis for conduit support installation.
- Update design output documents to be consistent with the completed design basis.
- Revise construction, maintenance, and quality assurance (QA) procedures to incorporate design output requirements.
- Develop and implement a critical case evaluation of existing installations with corrective actions as necessary.
- Submit a technically justified Final Safety Analysis Report (FSAR) revision to NRC to update damping values and clarify the use of spectral accelerations.